

## Methane Post-Processing for Oxygen Loop Closure

State-of-the-art United States Atmospheric Revitalization carbon dioxide ( $\text{CO}_2$ ) reduction is based on the Sabatier reaction process, which recovers approximately 50% of the oxygen ( $\text{O}_2$ ) from crew metabolic  $\text{CO}_2$ . Oxygen recovery from carbon dioxide is constrained by the limited availability of reactant hydrogen. Post-processing of methane to recover hydrogen with the Umpqua Research Company Plasma Pyrolysis Assembly (PPA) has the potential to further close the Atmospheric Revitalization oxygen loop. The PPA decomposes methane into hydrogen and hydrocarbons, predominantly acetylene, and a small amount of solid carbon. The hydrogen must then be purified before it can be recycled for additional oxygen recovery. Long duration testing and evaluation of a four crew-member sized PPA and a discussion of hydrogen recycling system architectures are presented.